Aug. 27, 1968 ICHIRO TSUNODA 3,398,480

AUTOMATIC APPARATUS FOR CONTROLLING ELECTRICALLY DRIVEN TOYS

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Fig. 1

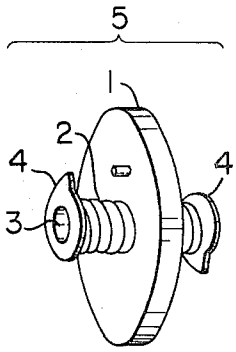


Fig. 4

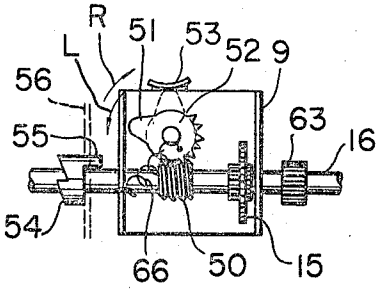
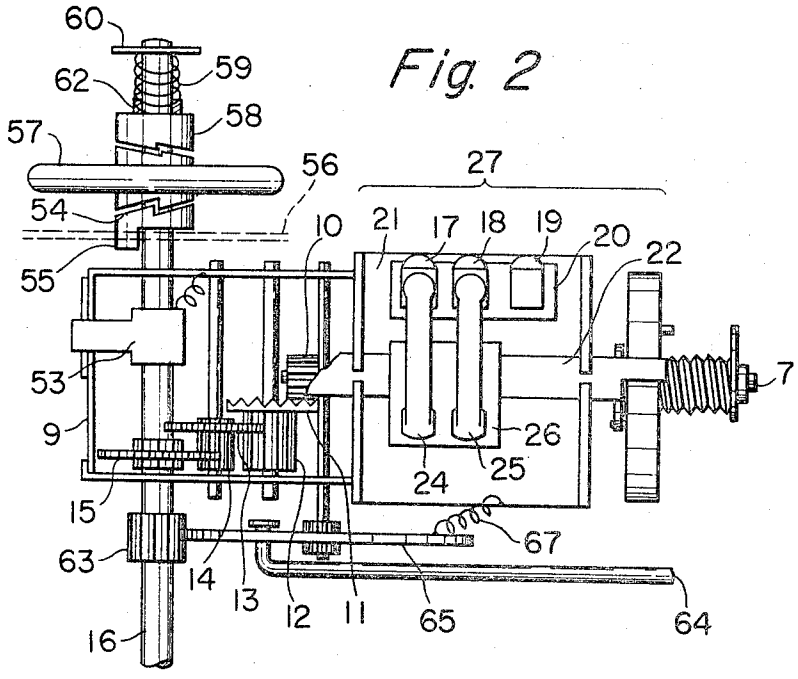


Fig. 2



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AUTOMATIC APPARATUS FOR CONTROLLING ELECTRICALLY DRIVEN TOYS

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Fig. 3

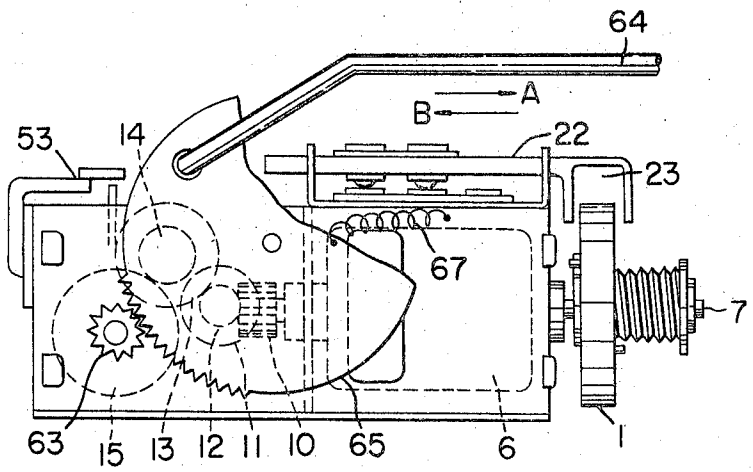

Fig. 5

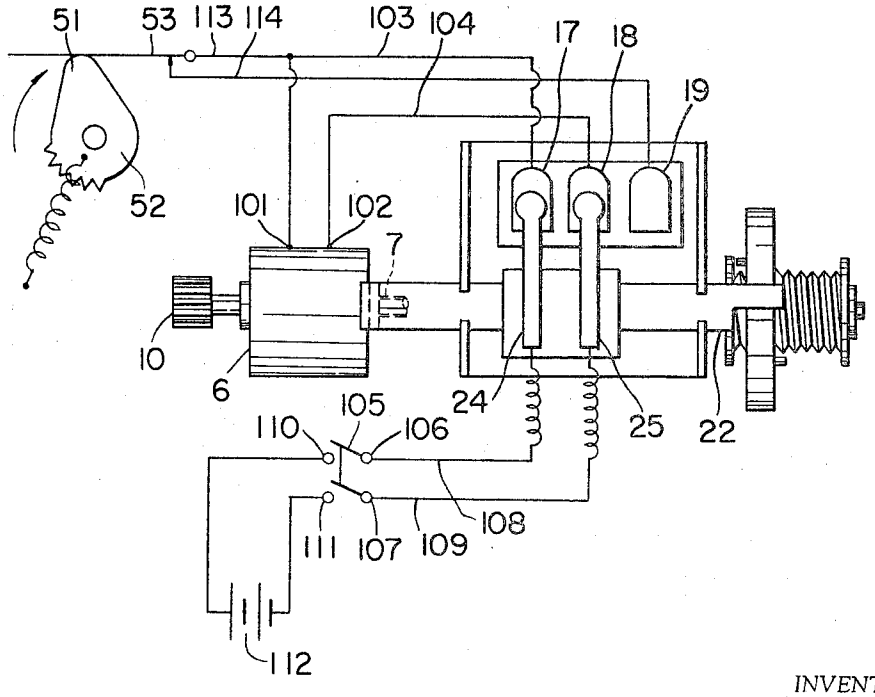

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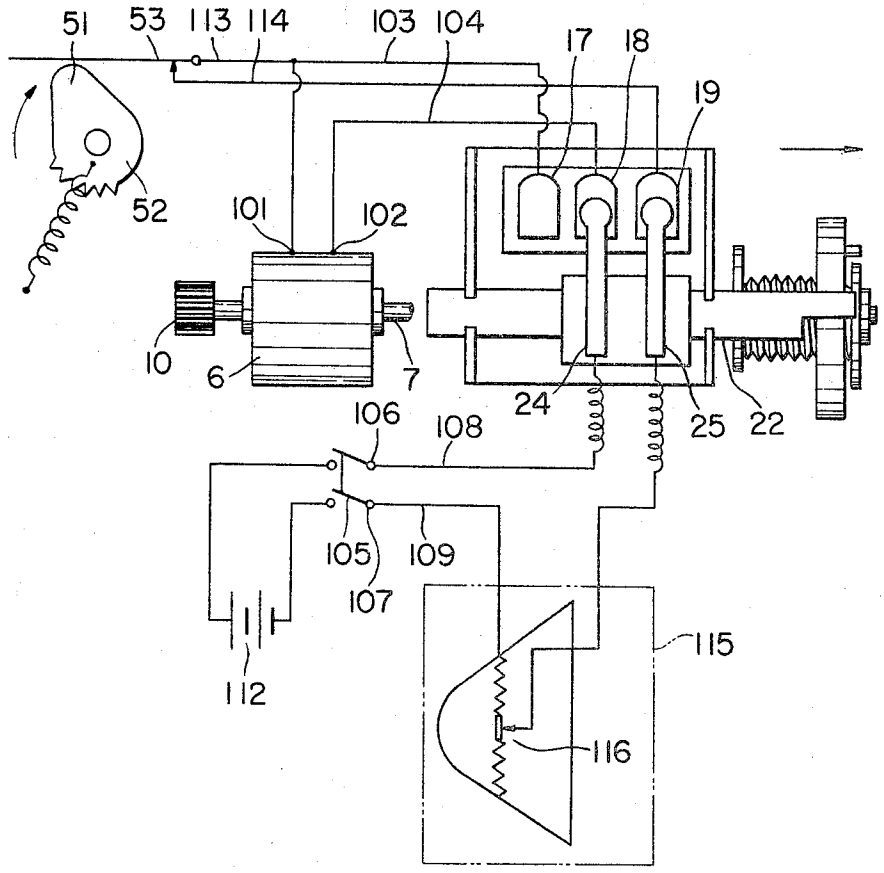
Fig. 6



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United States Patent Office 3,398,480
Patented Aug. 27, 1968

3,398,480

AUTOMATIC APPARATUS FOR CONTROLLING ELECTRICALLY DRIVEN TOYS

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Filed Aug. 31, 1965, Ser. No. 483,964
Claims priority, application Japan, Sept. 10, 1964, 39/51,080
4 Claims. (Cl. 46—244)

This invention relates to an automatic apparatus for controlling electrically driven toys, more particularly relates to an automatic apparatus in which the sense of the rotating direction of the motor electrically driving a toy is reversed when the inertial element provided on the shaft of the motor transfers a reversing switch in accordance with the sudden decrement of the rotation of the motor and also in which the sense of the rotating direction of the motor is again reversed to the original sense of the rotating direction.

The apparatus for controlling electrically driven toys of this invention provides an inertial element which comprises an inertial disc, a rod with screws fitted loosely within the center hole of the inertial disc and provided with a center bore into which the shaft of the motor is inserted and a pair of washers preventing the inertial disc from escaping away from the rod and fitted at the both ends of the rod, and also provides a reversing switch operated by the inertial disc as the disc shifts along the shaft of the motor. The inertial element transfers the reversing switch to reverse the sense of the rotating direction of the motor in accordance with the sudden decrement of the rotation of the motor and, thereafter, the sense of the rotating direction of the motor is again reversed to the orignal sense of the rotating direction.

An object of this invention is to provide an automatic apparatus for controlling electrically driven toys having interesting and smooth motion which reverse the sense of the rotating direction repeatedly.

The apparatus for controlling electrically driven toys of this invention provides a set of ratchet means fixed on the shaft for driving the toys and on the driven member, respectively, said ratchet means rotating with the shaft for driving the toys when said driving shaft rotates in the forward direction (the normal directon) and locking the driven member when said driving shaft rotates in the backward direction (the reverse direction).

Therefore, another object of this invention is to provide an automatic apparatus for controlling electrically driven toys having different mode of operation in accordance with the sense of the rotating direction of the motor.

The apparatus for controlling electrically driven toys of this invention provides means for pushing or pulling a connecting rod mounted on a gear of irregular shape meshing with a pinion gear mounted on the driving shaft, in accordance with the sense of the rotating direction in the forward direction (the normal direction) or in the backward direction (the reverse direction). The means operates to steer the rear wheels of the toys or to move the blade of a bulldozer toy.

Therefore, a further object of this invention is to provide an automatic apparatus for controlling electrically driven toys in which steering of the rear wheels or moving the blade of the toys is recognized as if the steering or the moving was effected by only the operator's will.

The apparatus for controlling electrically driven toys of this invention provides a self disconnecting which operated by a cam having gears engaging with a worm fixed on the shaft for driving the toys.

The electrical circuit of the apparatus for controlling electrically driven toys of this invention can be provided with switch means which has a contact being opened by the vibration of a sound wave receiver operated by the sound coming from a whistle and the like.

Therefore, a further object of this invention is to provide an automatic apparatus for controlling electrically driven toys in which the sense of the rotating direction of the motor electrically driving the toys is reversed when the inertial element provided on the shaft of the motor operates in accordance with the sudden decrement of the rotation of the motor not only due to the variation of the external load but also due to the cutting off of the circuit connecting the motor to an electrical source.

These objects and advantages of this invention will become apparent upon a study of the following specification and drawings of which:

FIG. 1 is a perspective view of an inertial element constituting a part of the apparatus for controlling electrically driven toys of this invention,

FIG. 2 is a plan view of the apparatus for controlling electrically driven toys of this invention, which is partially cut off,

FIG. 3 is an elevational view of the apparatus shown in FIG. 2, which is partially cut off,

FIG. 4 is a plan view of the self disconnecting switch mounted on a shaft for driving the toys,

FIG. 5 is a skeleton diagram showing the electrical connection of the apparatus shown in FIG. 2, in one operating condition, and

FIG. 6 is a skeleton diagram showing the electrical connection of the apparatus shown in FIG. 2 in the other operating condition utilizing the sound wave receiver.

In FIG. 1, a rod **2** with a male screw on the surface thereof and a center bore **3** therethrough is loosely fitted into the hole of an inertial disc **1** and the hole is provided with a female screw engaging with the male screw of rod **2**. A pair of washers **4** and **4'** are secured at either end of rod **2** in order to prevent inertial disc **1** from escaping from rod **2**. The combination of inertial disc **1**, rod **2** and a pair of washers **4** and **4'** is referred to an inertial element **5**, hereinafter.

A shaft **7** of motor **6** for driving toy assembly **8** is inserted into center bore **3**. A pinion gear **10** mounted on one end of shaft **7** and gears **11**, **12**, **13**, **14** and **15** are arranged within a frame **9** in order to rotate a shaft **16** for driving rear wheels **57**.

Fixed contacts **17**, **18** and **19** are mounted on a base **20** fixed on a support **21** used for supporting reversing switch **27**. A lever **22** which is inserted into the both side walls of support **21** is provided with a U-shaped end **23** at the extremity thereof. U-shaped end **23** limits the axial movement of inertial disc **1**. A pair of slidable leaf spring contacts **24** and **25** engages with a pair of fixed contacts **17** and **18** or a pair of fixed contacts **18** and **19** and leaf spring contacts **24** and **25** are mounted on a base **26** fixed to lever **22**. A reversing switch **27** comprises base **20** with fixed contacts **17**, **18** and **19**, a support **21**, a lever **22**, and a pair of leaf spring contacts **24** and **25** and is mounted on the upper part of toy assembly **8** as shown in FIGS. 2 and 3.

In FIG. 4, worm **50** secured on shaft **16** meshes with a gear **52** constituting a peripheral part of a cam **21**. When shaft **16** rotates in the normal direction cam **51** rocks downward as shown by the arrow L and when shaft **16** rotates in the reverse direction cam **51** rocks upward as shown by the arrow R so that self disconnecting switch **53** opens.

A ratchet **54** is mounted on shaft **16** rotatably and a projection **55** of ratchet **54** is inserted into a hole provided in a chassis **56** of the toy or frame of the toy so that ratchet **54** does not rotate with the rotation of shaft **16**. A driven member **57**, such as the wheel of the toy assembly, with a pair of ratchet on either side of driven member **57** is rotatably mounted on shaft **16**. A

ratchet **58** and a spring **59** urging ratchet **58** to driven member **57** are also rotatably mounted on shaft **16** so that ratchet **58** meshes with a ratchet on either side of driven member **57**. A washer **60** is fixed on shaft **16** so as to prevent ratchet **54**, driven member **57**, ratchet **58** and spring **59** from escaping from shaft **16**. A projection **62** provided on shaft **16** is inserted into a slot provided in ratchet **58** so that ratchet **58** can rotate with shaft **16** when ratchet **58** shifts towards driven member **57** by being urged by spring **59**.

In FIG. 3, a pinion gear **63** fixed on shaft **16** has a part of the teeth removed from the periphery thereof and meshes with a gear **65** of an irregular shape. Gear **65** can operate connecting rod **64** depending on the direction of the rotation of the motor and at the extremity of rod **64** is provided a utilization device, such as a steering apparatus or the blade of a bulldozer.

In FIGS. 5 and 6, terminals **101** and **102** are connected to fixed contacts **17** and **18**, respectively, through lead wires **103** and **104** and slidable leaf spring contacts **24** and **25** are connected to a D.C. source **112** through lead wires **108** and **109**, and switch **105**, respectively. The two terminals of self disconnecting switch **53** are connected to fixed contacts **17** and **19** through lead wires **113** and **114**, respectively. A vibrating contact **116** of a sound wave receiver **115** is, as shown in FIG. 6, connected in series with lead wire **109**, said contact **116** being opened or the contact resistance of contact **116** being increased by the vibration received by the sound wave receiver to the effect that the rotation of motor **6** is suddenly decreased.

Spring **66** is fixed to gear **52** at one end thereof and to frame **9** at the other end thereof and biases gear **52** in the clockwise direction in FIG. 4 so that gear **52** normally meshes with worm **50**. Spring **67** is fixed to gear **65** at one end thereof and to motor **6** at the other end thereof and biases gear **65** in the clockwise direction in FIG. 3 so that gear **65** normally meshes with pinion gear **63**.

The operation of the automatic apparatus for controlling the electrically driven toys provided in accordance with this invention is explained as follows: Assuming that inertial disc **1** is in the position shown in FIGS. 2, 3 and 5, when switch **105** is closed motor **6** begins to rotate to a direction, referred to the normal direction hereinafter, as leaf spring contacts **24** and **25** engage with fixed contacts **17** and **18**, respectively. The circuit for energizing motor **6** is traced as follows: from the positive terminal of D.C. source **112** through a fixed contact **110** of switch **105**, a movable contact **106** of switch **105**, lead wire **108**, leaf spring contact **24**, fixed contact **17**, lead wire **103**, terminal **101**, motor **6**, terminal **102**, lead wire **104**, fixed contact **18**, leaf spring contact **25**, lead wire **109**, a movable contact **107** of switch **105** and a fixed contact **111** of switch **105** to the negative terminal of D.C. source **112**.

Under this condition the toy advances in forward direction and cam **51** of self disconnecting switch **53** is at the downward position as shown by the arrow L. When the rotation of motor **6** decreases suddenly by the increment of an external load or a contact resistance of the contact of the sound wave receiver, inertial disc **1** shifts to the right as shown in FIG. 6 in the axial direction of lever **22** since the rotation of inertial disc **1** caused due to the inertia continues after the rotation of rod **2** decreases by the increment of an external load or a contact resistance of the contact of the sound wave receiver. Lever **22** advances to the right out of support **21** as shown in FIG. 6 and leaf spring contacts **24** and **25** engage with fixed contacts **18** and **19**, respectively. The circuit for energizing motor **6** is traced as follows: from the positive terminal of D.C. source **112** through a fixed contact **110**, a movable contact **106**, lead wire **108**, leaf spring contact **24**, fixed contact **18**, lead wire **104**, terminal **102**, motor **6**, terminal **101**, lead wire **113**, self disconnecting switch **53**, lead wire **114**, fixed contact **19**, leaf spring contact **25**, sound wave receiver **115** if necessary, lead wire **109**, a movable contact **107** and a fixed contact **111** to the negative terminal of D.C. source **112**. The polarity of the potential applied to motor **6** is now reversed so that the motor begins to rotate in the reverse direction. Cam **51** rocks upward in FIG. 4 in the direction shown by the arrow R to open self disconnecting switch **53**. Inertial element **5** is again shifted to the left in FIG. 6 to the effect that base **26** for leaf spring contacts is shifted to the left. Leaf spring contacts **24** and **25** engage with fixed contacts **17** and **18**, respectively, and motor **6** begins to rotate again in the normal direction.

In conclusion, the toys advancing forward reverse the moving direction by the increment of the external load or the contact resistance of the contact of the sound wave signal. Since driven member **57** does not rotate with the backward moving of the toys and connecting rod **64** can be used to steer the toys to modify the direction of the backward movement of the toys, when the toys advance again forward in the normal direction the latter direction of advancing differs from the former direction of advancing so that the toys seems to be controlled at the operator's own will. At the movement in the reverse direction connecting rod **64** can be used to raise the blade of a bulldozer and at the movement in the normal direction connecting rod **64** can be used to lower the blade to the effect that the toys can be operated at the operator's own will.

What is claimed is:

1. In electrically driven toys provided with an inertial element comprised of an inertial disc, a rod with screws fitted loosely within the center hole of the inertial disc and provided with a center bore into which the shaft of a motor electrically driving the toys is inserted and a pair of washers preventing the inertial disc from escaping the rod and fitted at both ends of the rod, and provided with a reversing switch for transferring the polarity of the potential applied to the motor,

an automatic apparatus for controlling the electrically driven toys comprising:

a self disconnecting switch operated by a cam having gears engaging a worm fixed on the shaft for driving the toys, and

a set of ratchet means fixed on the shaft for driving the toys and on the driven member, respectively,

said set of ratchet means rotating with the shaft for driving the toys when said driving shaft rotates in the forward direction and locking the driven member when said driving shaft rotates in the backward direction.

2. In electrically driven toys provided with an inertial element comprised of an inertial disc, a rod with screws fitted loosely within the center hole of the inertial disc and provided wth a center bore into which the shaft of a motor electrically driving the toys is inserted and a pair of washers preventing the inertial disc from escaping the rod and fitted at both ends of the rod, and provided with a reversing switch for transferring the polarity of the potential applied to the motor,

an automatic apparatus for controlling the electrically driven toys comprising:

a self disconnecting switch operated by a cam having gears engaging a worm fixed on the shaft for driving the toys, and

means for pushing or pulling a connecting rod mounted on a gear of irregular shape meshing with a pinion gear mounted on the shaft for driving the toys,

said means for pushing or pulling a connecting rod operating to steer the rear wheels of the toys.

3. In electrically driven toys provided with an inertial element comprised of an inertial disc, a rod with screws fitted loosely within the center hole of the inertial disc and provided with a center bore into which the shaft of

a motor electrically driving the toys is inserted and a pair of washers preventing the inertial disc from escaping the rod and fitted at both ends of the rod, and provided with a reversing switch for transferring the polarity of the potential applied to the motor,

an automatic apparatus for controlling the electrically driven toys comprising:

a self disconnecting switch operated by a cam having gears engaging a worm fixed on the shaft for driving the toys, and

switch means having a contact being opened by the vibration of a sound wave receiver operated by the sound coming from a whistle,

said switch means being connected in series with the circuit connecting the motor to an electrical source.

4. In electrically driven toys provided with an inertial element comprised of an inertial disc, a rod with screws fitted loosely within the center hole of the inertial disc and provided with a center bore into which the shaft of a motor electrically driving the toys is pressed and a pair of washers preventing the inertial disc from escaping the rod and fitted at the both ends of the rod, and provided with a reversing switch for transferring the polarity of the potential applied to the motor,

an automatic apparatus for controlling the electrically driven toys comprising:

a self disconnecting switch operated by a cam having gears engaging with a worm fixed on the shaft for driving the toys,

a set of ratchet means fixed on the shaft for driving the toys and on the driven member, respectively,

said set of ratchet means rotating with the shaft for driving toys when said driving shaft rotates in the forward direction and locking the driven member when said driving shaft rotates in the backward direction, and

means for pushing or pulling a connecting rod mounted on a gear of irregular shape meshing with a pinion gear mounted on the shaft for driving the toys,

said means for pushing or pulling a connecting rod operating to move the blade of a bulldozer toy.

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